DATA SHEET

NEC

PHOTOCOUPLER

PS2535-1,PS2535L-1

HIGH COLLECTOR TO EMITTER VOLTAGE HIGH ISOLATION VOLTAGE MULTI PHOTOCOUPLER SERIES

–NEPOC Series–

DESCRIPTION

The PS2535-1 and PS2535L-1 are optically coupled isolators containing a GaAs light emitting diode and an NPN silicon darlington connected phototransistor.

A high withstanding voltage between the I/O, the high voltage between the collector and emitter of the transistor, and darlington transistor output enables low-current input.

The PS2535-1 is in a plastic DIP (Dual In-line Package) and the PS2535L-1 is lead bending type (Gull-wing) for surface mount.

FEATURES

- High collector to emitter voltage (V_{CEO} = 350 V)
- High isolation voltage (BV = 5 000 Vr.m.s.)
- High current transfer ratio (CTR = 1 500 % TYP.)
- Ordering number of taping product: PS2535L-1-E3, E4, F3, F4

APPLICATIONS

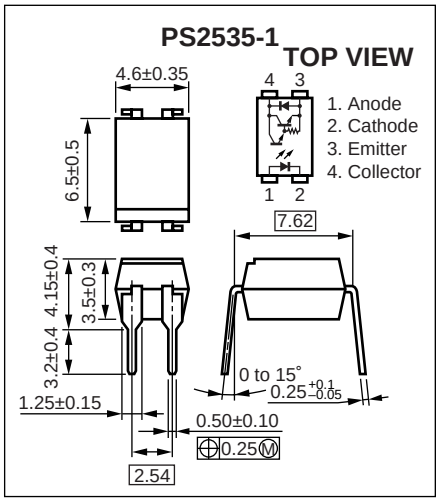
- Telephone, Exchange equipment
- FAX/MODEM

Document No. PN10447EJ01V0DS (1st edition)
(Previous No. P14066EJ2V0DS00)
Date Published November 2003 CP(K)
Printed in Japan

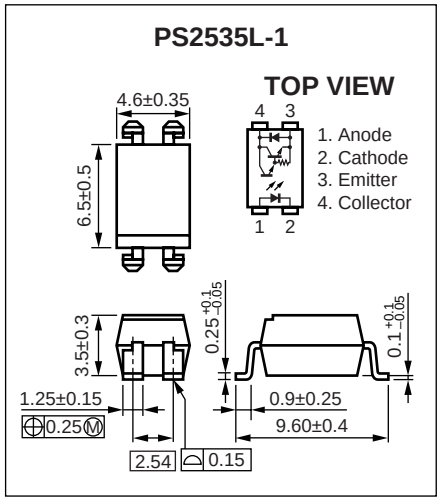
The mark ★ shows major revised points.

★ **PACKAGE DIMENSIONS (Unit : mm)**

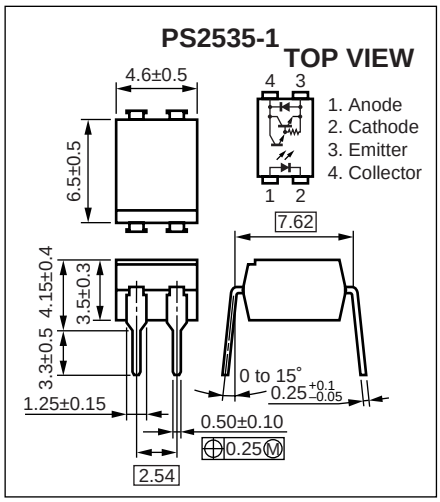
DIP Type (New package)



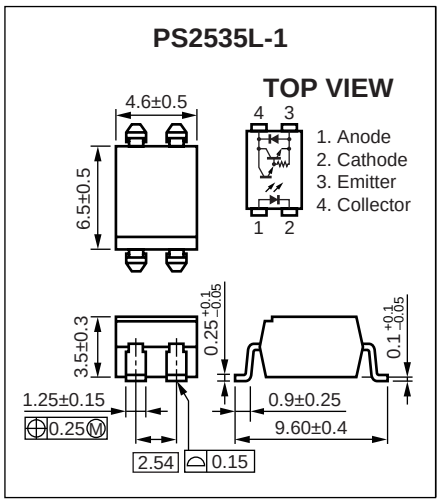
Lead Bending Type (New package)



DIP Type

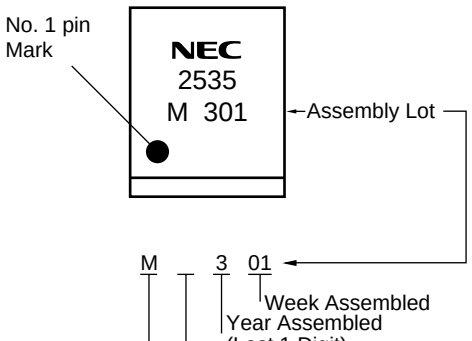


Lead Bending Type



★ **MARKING EXAMPLE**

PS2535-1



Package	Made in Japan	Made in Taiwan
Standard PKG	Blank	F
New PKG	E	

★ ORDERING INFORMATION

Part Number	Package	Packing Style	Application Part Number*1
PS2535-1	4-pin DIP	Magazine case 100 pcs	PS2535-1
PS2535L-1			
PS2535L-1-E3		Embossed Tape 1 000 pcs/reel	
PS2535L-1-E4			
PS2535L-1-F3		Embossed Tape 2 000 pcs/reel	
PS2535L-1-F4			

***1** For the application of the Safety Standard, following part number should be used.

★ ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C, unless otherwise specified)

Parameter		Symbol	Ratings	Unit
Diode	Forward Current (DC)	I_F	50	mA
	Reverse Voltage	V_R	6	V
	Power Dissipation Derating	ΔP_D/°C	0.7	mW/°C
	Power Dissipation	P_D	70	mW
	Peak Forward Current*1	I_{FP}	0.5	A
Transistor	Collector to Emitter Voltage	V_{CEO}	350	V
	Emitter to Collector Voltage	V_{ECO}	0.3	V
	Collector Current	I_C	120	mA
	Power Dissipation Derating	ΔP_C/°C	2.0	mW/°C
	Power Dissipation	P_C	200	mW
Isolation Voltage*2		BV	5 000	Vr.m.s.
Operating Ambient Temperature		T_A	–55 to +100	°C
Storage Temperature		T_{stg}	–55 to +150	°C

***1** PW = 100 μs, Duty Cycle = 1 %

***2** AC voltage for 1 minute at T_A = 25 °C, RH = 60 % between input and output

ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

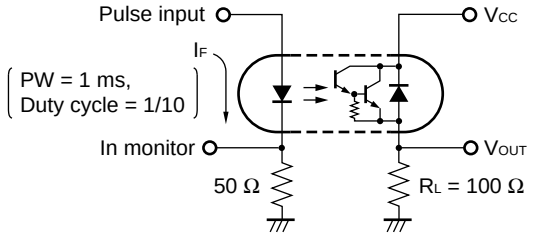
	Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit
	Diode	Forward Voltage	V_F	I_F = 10 mA		1.2	1.4	V
		Reverse Current	I_R	V_R = 5 V			5	μA
★		Terminal Capacitance	C_t	V = 0 V, f = 1.0 MHz		15		pF
★	Transistor	Collector to Emitter Dark Current	I_{CEO}	V_{CE} = 350 V, I_F = 0 mA			400	nA
	Coupled	Current Transfer Ratio (I_C/I_F) *1	CTR	I_F = 1 mA, V_{CE} = 2 V	400	1 500	5 500	%
		Collector Saturation Voltage	$V_{CE (sat)}$	I_F = 1 mA, I_C = 2 mA			1.0	V
		Isolation Resistance	R_{I-O}	V_{I-O} = 1.0 kV_{DC}	10^{11}			Ω
		Isolation Capacitance	C_{I-O}	V = 0 V, f = 1.0 MHz		0.6		pF
		Rise Time *2	t_r	V_{CC} = 5 V, I_C = 10 mA, R_L = 100 Ω		18		μs
		Fall Time *2	t_f			5		

***1** CTR rank

N : 400 to 5 500 (%)

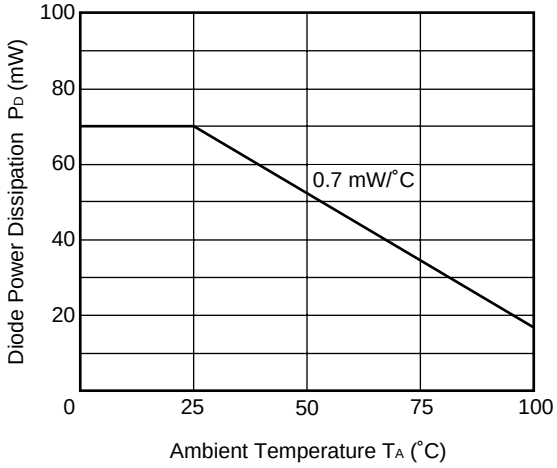
L : 1 500 to 5 500 (%)

***2** Test circuit for switching time

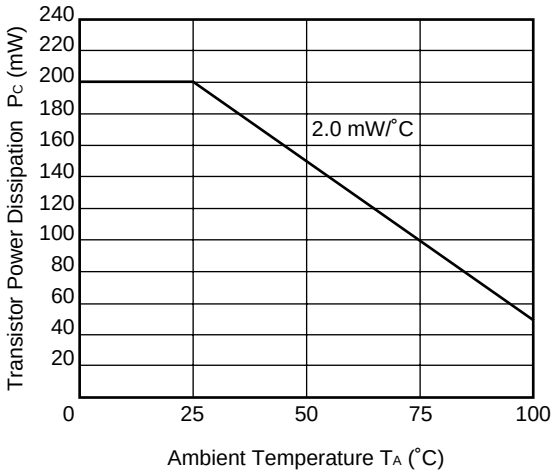


TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise specified)

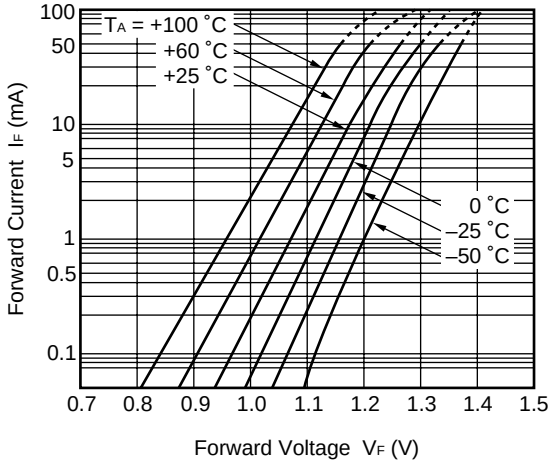
DIODE POWER DISSIPATION vs. AMBIENT TEMPERATURE



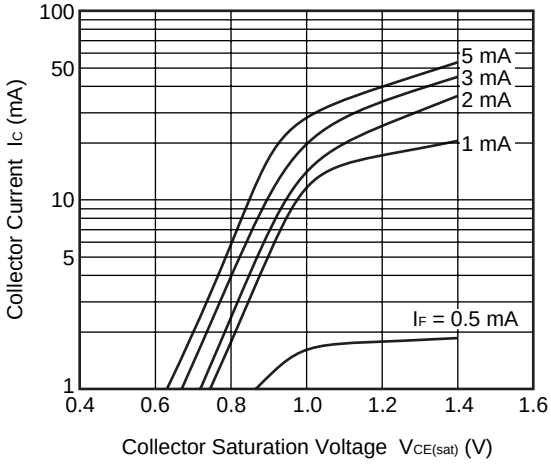
TRANSISTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



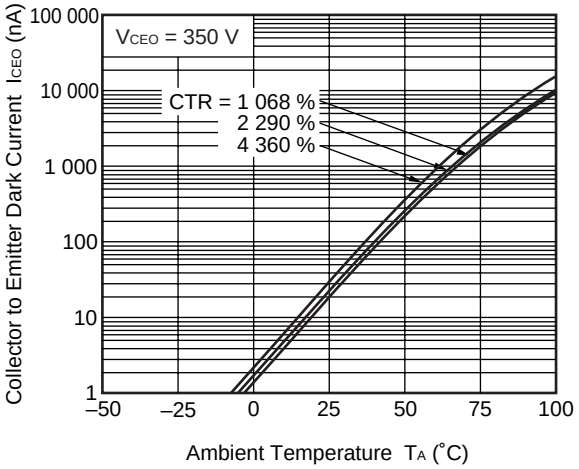
FORWARD CURRENT vs. FORWARD VOLTAGE



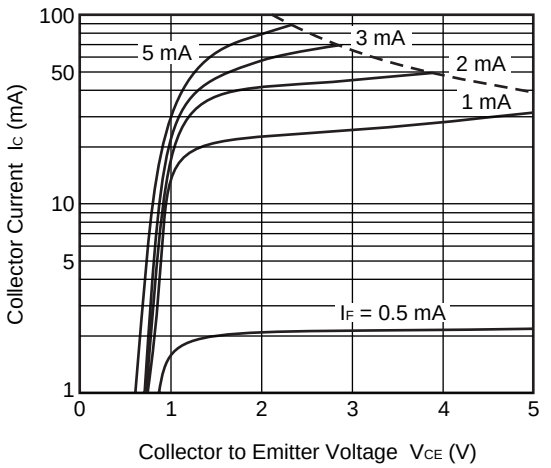
COLLECTOR CURRENT vs. COLLECTOR SATURATION VOLTAGE



★ COLLECTOR TO EMITTER DARK CURRENT vs. AMBIENT TEMPERATURE

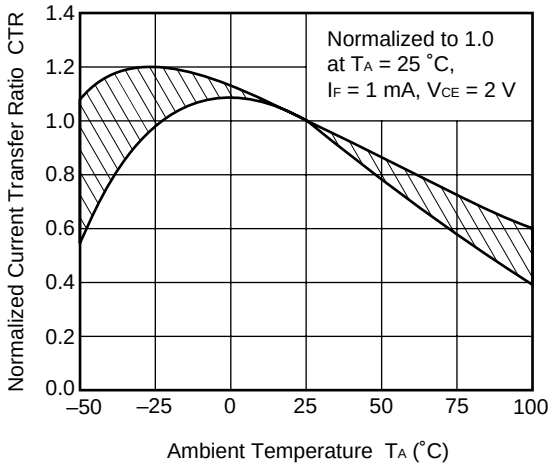


COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE

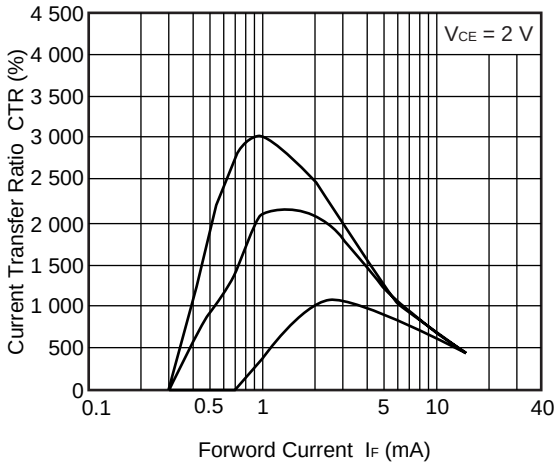


Remark The graphs indicate nominal characteristics.

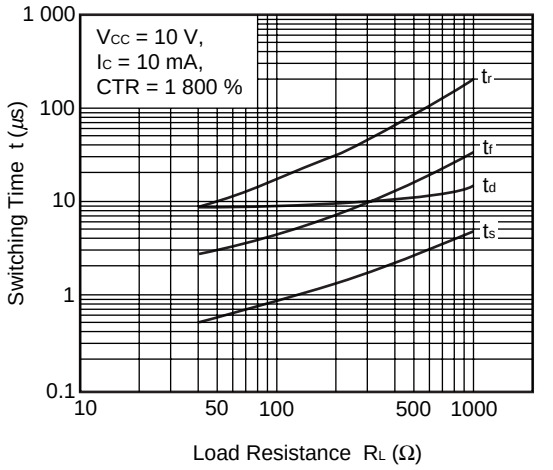
NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERTURE



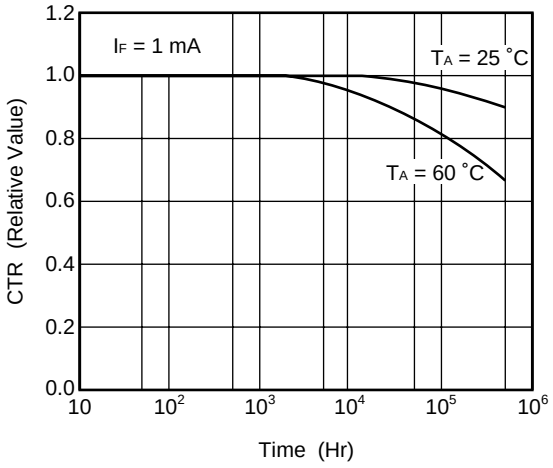
CURRENT TRANSFER RATIO vs. FORWARD CURRENT



SWITCHING TIME vs. LORD RESISTANCE



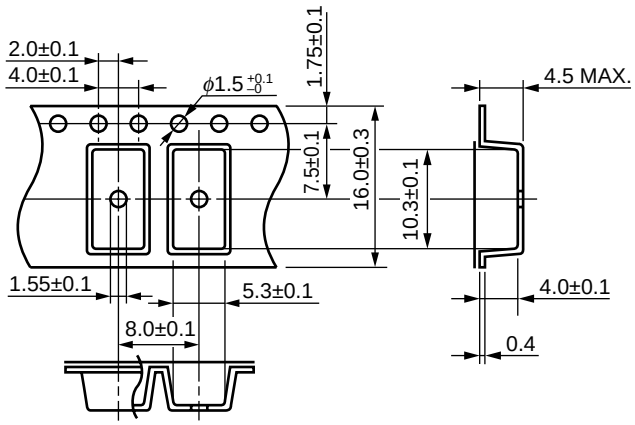
LONG TERM CTR DEGRADATION



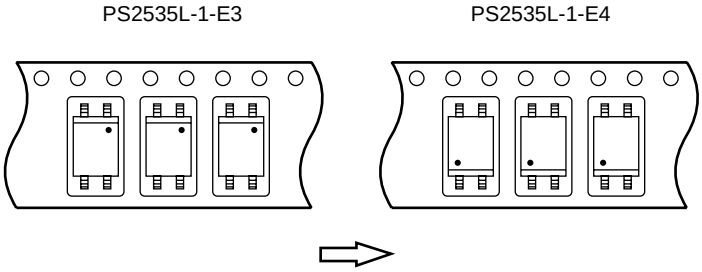
Remark The graphs indicate nominal characteristics.

★ **TAPING SPECIFICATIONS (in millimeters)**

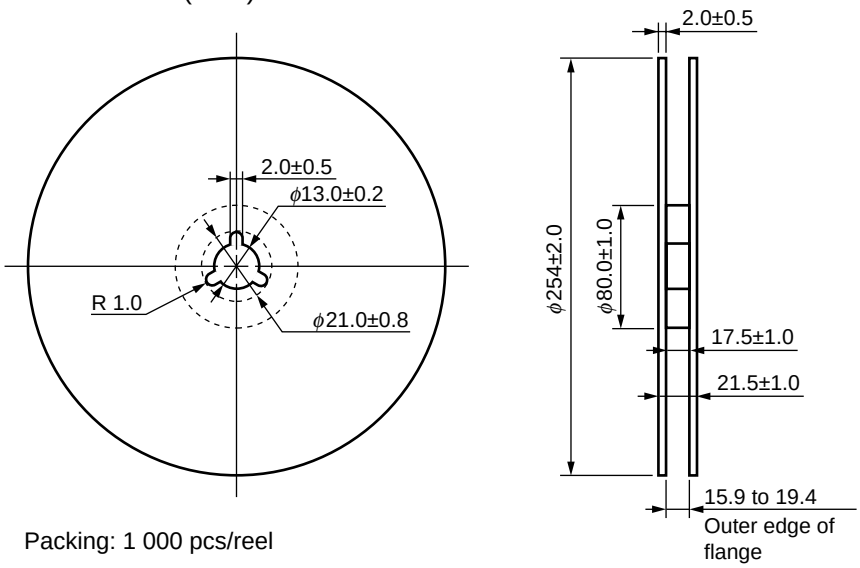
Outline and Dimensions (Tape)



Tape Direction

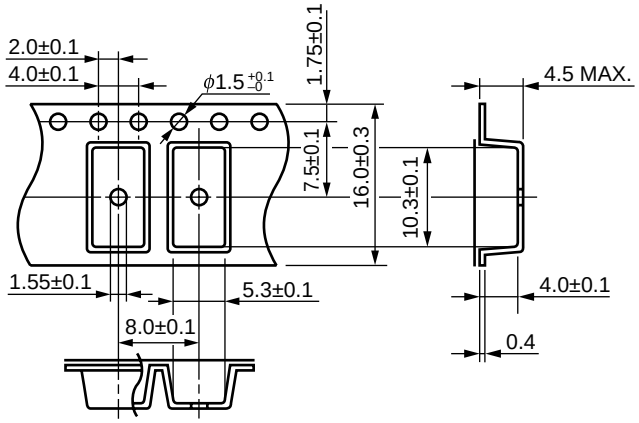


Outline and Dimensions (Reel)

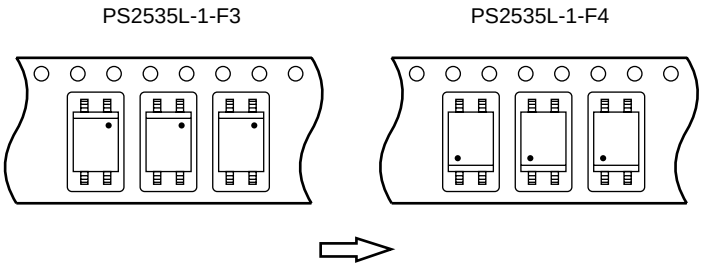


Packing: 1 000 pcs/reel

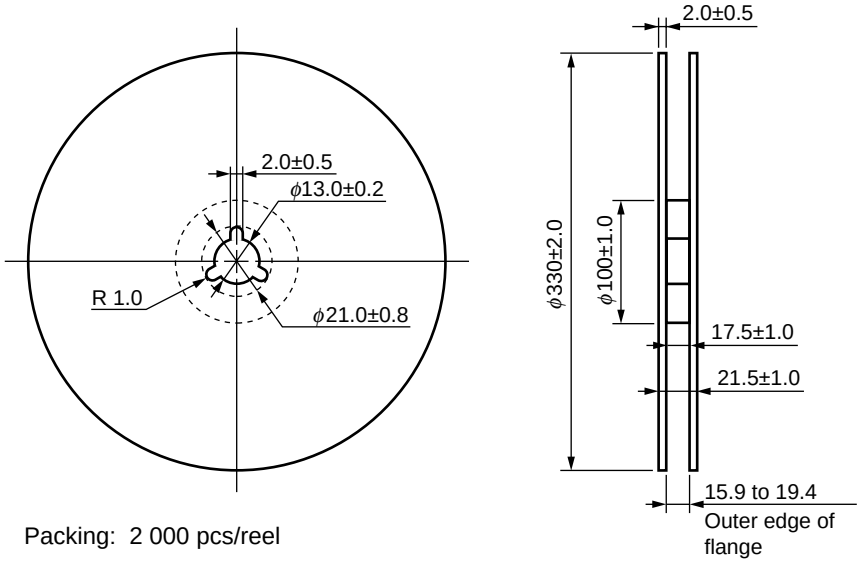
Outline and Dimensions (Tape)



Tape Direction



Outline and Dimensions (Reel)



Packing: 2 000 pcs/reel

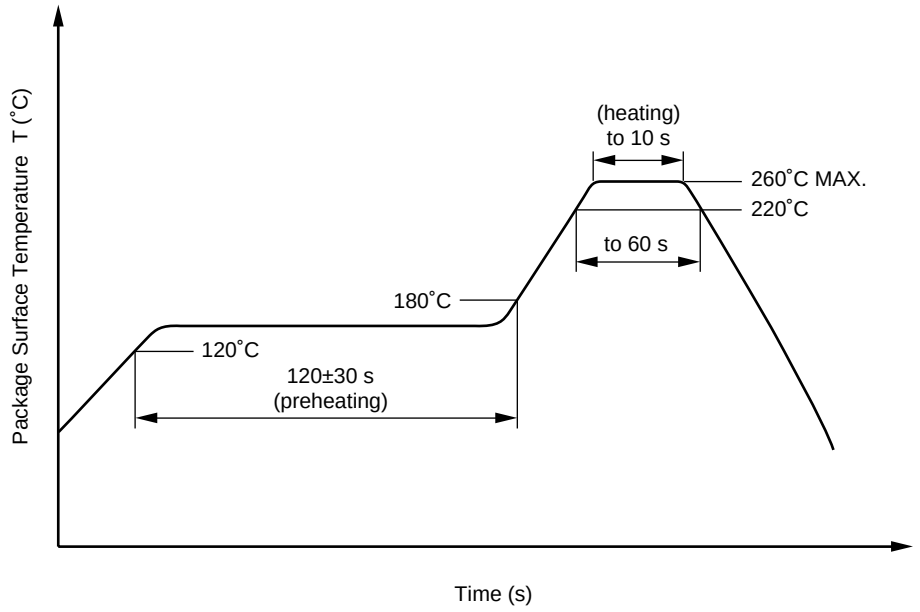
★ NOTES ON HANDLING

1. Recommended soldering conditions

(1) Infrared reflow soldering

• Peak reflow temperature	260°C or below (package surface temperature)
• Time of peak reflow temperature	10 seconds or less
• Time of temperature higher than 220°C	60 seconds or less
• Time to preheat temperature from 120 to 180°C	120±30 s
• Number of reflows	Three
• Flux	Rosin flux containing small amount of chlorine (The flux with a maximum chlorine content of 0.2 Wt% is recommended.)

Recommended Temperature Profile of Infrared Reflow



(2) Wave soldering

• Temperature	260°C or below (molten solder temperature)
• Time	10 seconds or less
• Preheating conditions	120°C or below (package surface temperature)
• Number of times	One (Allowed to be dipped in solder including plastic mold portion.)
• Flux	Rosin flux containing small amount of chlorine (The flux with a maximum chlorine content of 0.2 Wt% is recommended.)

(3) Cautions

• Fluxes

Avoid removing the residual flux with freon-based and chlorine-based cleaning solvent.

2. Cautions regarding noise

Be aware that when voltage is applied suddenly between the photocoupler's input and output or between collector-emitters at startup, the output side may enter the on state, even if the voltage is within the absolute maximum ratings.

★ USAGE CAUTIONS

1. Protect against static electricity when handling.
2. Avoid storage at a high temperature and high humidity.

- **The information in this document is current as of November, 2003. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC's data sheets or data books, etc., for the most up-to-date specifications of NEC semiconductor products. Not all products and/or types are available in every country. Please check with an NEC sales representative for availability and additional information.**
- No part of this document may be copied or reproduced in any form or by any means without prior written consent of NEC. NEC assumes no responsibility for any errors that may appear in this document.
- NEC does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from the use of NEC semiconductor products listed in this document or any other liability arising from the use of such products. No license, express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC or others.
- Descriptions of circuits, software and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software and information in the design of customer's equipment shall be done under the full responsibility of customer. NEC assumes no responsibility for any losses incurred by customers or third parties arising from the use of these circuits, software and information.
- While NEC endeavours to enhance the quality, reliability and safety of NEC semiconductor products, customers agree and acknowledge that the possibility of defects thereof cannot be eliminated entirely. To minimize risks of damage to property or injury (including death) to persons arising from defects in NEC semiconductor products, customers must incorporate sufficient safety measures in their design, such as redundancy, fire-containment, and anti-failure features.
- NEC semiconductor products are classified into the following three quality grades:
  "Standard", "Special" and "Specific". The "Specific" quality grade applies only to semiconductor products developed based on a customer-designated "quality assurance program" for a specific application. The recommended applications of a semiconductor product depend on its quality grade, as indicated below. Customers must check the quality grade of each semiconductor product before using it in a particular application.
  "Standard": Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots
  "Special": Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)
  "Specific": Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems and medical equipment for life support, etc.
  The quality grade of NEC semiconductor products is "Standard" unless otherwise expressly specified in NEC's data sheets or data books, etc. If customers wish to use NEC semiconductor products in applications not intended by NEC, they must contact an NEC sales representative in advance to determine NEC's willingness to support a given application.
  (Note)
  (1) "NEC" as used in this statement means NEC Corporation, NEC Compound Semiconductor Devices, Ltd. and also includes its majority-owned subsidiaries.
  (2) "NEC semiconductor products" means any semiconductor product developed or manufactured by or for NEC (as defined above).

M8E 00.4-0110

Caution GaAs Products	This product uses gallium arsenide (GaAs). GaAs vapor and powder are hazardous to human health if inhaled or ingested, so please observe the following points. • Follow related laws and ordinances when disposing of the product. If there are no applicable laws and/or ordinances, dispose of the product as recommended below. 1. Commission a disposal company able to (with a license to) collect, transport and dispose of materials that contain arsenic and other such industrial waste materials. 2. Exclude the product from general industrial waste and household garbage, and ensure that the product is controlled (as industrial waste subject to special control) up until final disposal. • Do not burn, destroy, cut, crush, or chemically dissolve the product. • Do not lick the product or in any way allow it to enter the mouth.

▶**For further information, please contact**

NEC Compound Semiconductor Devices, Ltd. **http://www.ncsd.necel.com/**
E-mail: salesinfo@ml.ncsd.necel.com (sales and general)
techinfo@ml.ncsd.necel.com (technical)
5th Sales Group, Sales Division TEL: +81-44-435-1588 FAX: +81-44-435-1579

NEC Compound Semiconductor Devices Hong Kong Limited
E-mail: ncsd-hk@elhk.nec.com.hk (sales, technical and general)
Hong Kong Head Office TEL: +852-3107-7303 FAX: +852-3107-7309
Taipei Branch Office TEL: +886-2-8712-0478 FAX: +886-2-2545-3859
Korea Branch Office TEL: +82-2-558-2120 FAX: +82-2-558-5209

NEC Electronics (Europe) GmbH **http://www.ee.nec.de/**
TEL: +49-211-6503-01 FAX: +49-211-6503-487

California Eastern Laboratories, Inc. **http://www.cel.com/**
TEL: +1-408-988-3500 FAX: +1-408-988-0279

0310